since 1828 — AMERICA'S OLDEST HOE SAW MANUFACTURER

TROUBLE-SHOOTING IN THE CIRCULAR SAWMILL

A GUIDE TO BETTER SAWN LUMBER AND INCREASED PRODUCTION INCLUDING MAINTENANCE AND CARE OF PORTABLE CIRCULAR SAWMILLS AND CHISEL-TOOTH SAWS

Operating AND Maintenance Manual

A HISTORY OF HOE AND THE SAW

R. HOE & CO., INC. • 8-60-10M • CAR PR • 80# CTD • 20 PG • PREP. BY GOODTREE

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PREFACE

The contents of this booklet—"Trouble Shooting in the Circular Saw Mill"—deals with conditions that develop with the Mill and/or Saw in the course of operations which lead to trouble, resulting in excess downtime, inaccurate lumber, ruined blades, etc.

In other words, this is a summary of the best known but seldom remembered, common or basic procedures handed down over the years. For use in checking out, isolating and correcting any trouble developing with the Mill and/or Saw, which was either overlooked in the initial installation of the Mill, or in "checking out" later on when trouble first developed.

These instructions, however, are not to be considered as a "cure-all" for the many undetectable "ills" pertinent to the Portable and Stationary Circular Saw Mill, therefore, some problems arising will require special treatment and we would consider it a privilege to be of assistance.

We have endeavored to make these instructions simple and easy to follow by incorporating line drawings to illustrate our description of "checking out" both Mill and Saw.

Any criticism you may have, whether constructive or otherwise, will enable us to issue a more complete and detailed instruction manual in the future.

R. HOE & CO., INC.

SELECTING THE PROPER SAW

The correct saw for your mill will depend upon the horsepower available, which in turn will govern the speed or RPM at which the saw can operate efficiently. With this information at hand the proper number and style of tooth can be calculated based on estimated or approximate rate of feed per RPM of Saw.

You will experience a minimum of trouble and obtain longer wear from bits and shanks, resulting in increased production at lower cost if you have a balance between feed, speed and the number of teeth in your saw.

Based on research information available, a log should be fed to the saw at a rate of feed so that each tooth is cutting a chip from 1/10″ to 1/8″ for successful and efficient operation.

The West Coast circular mills generally try to maintain a balance between feed, saw speed and number of teeth to produce a 1/8″ chip per tooth whereas Eastern mills, especially those sawing hardwood or frozen timber should, as outlined above, try to maintain a 1/10″ chip per tooth.

To determine the rate you are feeding, if not already known, swage one tooth so that a scratch mark will appear on the board and measure the distance between scratch marks.

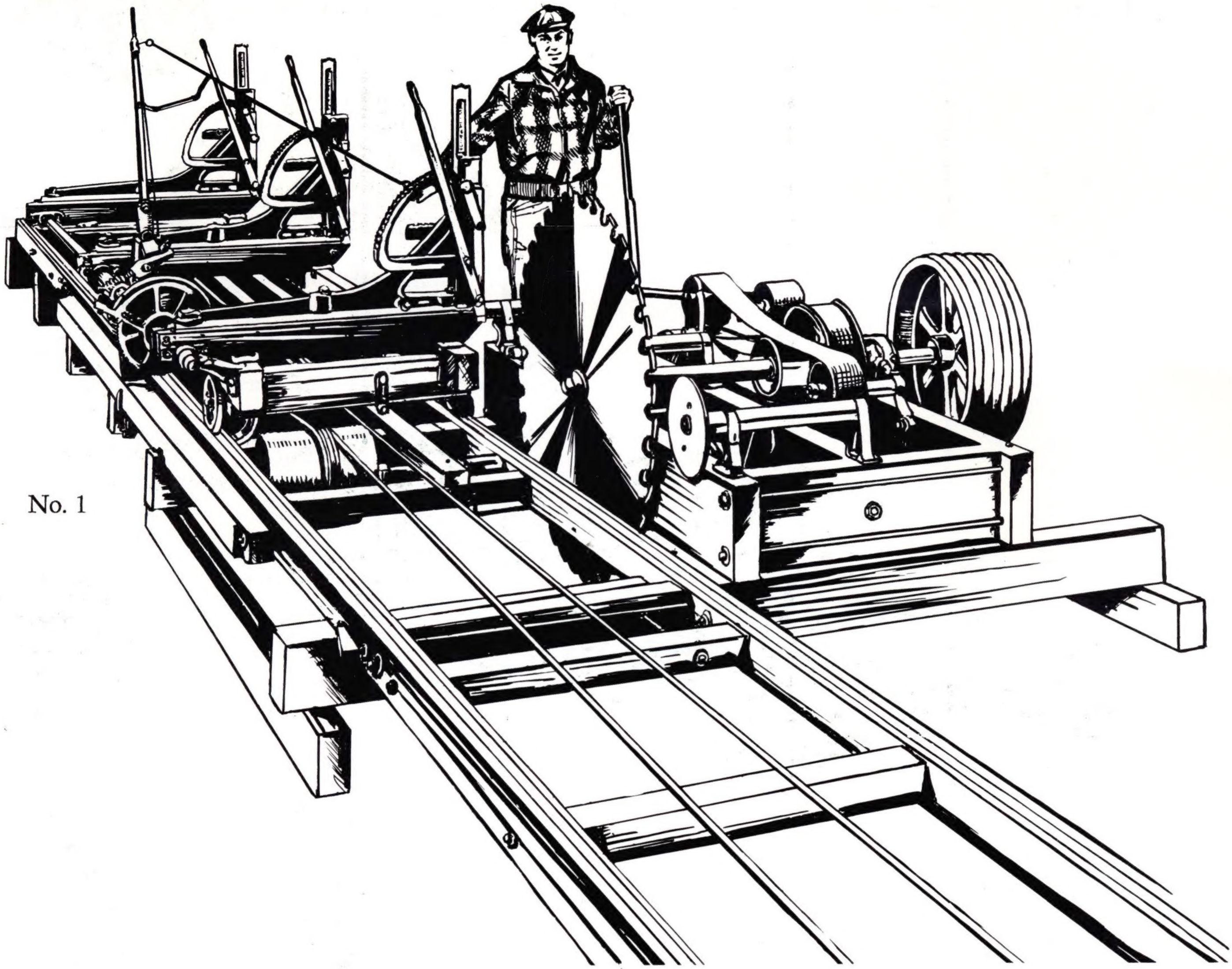
Upon receipt of information as to power, speed and diameter of average run of logs, we will recommend diameter saw and number of teeth required to give you the balance needed for maximum production sawing.

To get the most out of your mill and power:

1. The speed of saw should not be higher than can be maintained in the cut.
   a. The most efficient saw speed is that which can be maintained continuously in the cut.
   b. Production cannot be increased by simply speeding up the saw without having sufficient horsepower available to maintain the saw at any given speed in the cut.
   c. Maximum production is dependent on a balance between horsepower, speed of saw and rate of feed; with horsepower the leading factor and saw speed and feed secondary. Increased production in some cases has been attained by lowering the R.P.M. of saw.
2. Take advantage of full horsepower available by:
   a. Using a saw with standard number of teeth, or less if operating with light power and slow feed.
   b. If operating with plenty of power and fast feed use a saw with as many teeth as possible, based on information contained in preceding paragraphs.

In other words light power is overtaxed by a saw with too many teeth even with a slow feed—in addition to cutting fine dust, the extra teeth consume power and cause undue wear on bits and shanks.

On the other hand, a mill with plenty of power and a fast feed requires a saw with as many teeth as possible, especially in small knotty logs where gullet capacity is not required.



No. 1

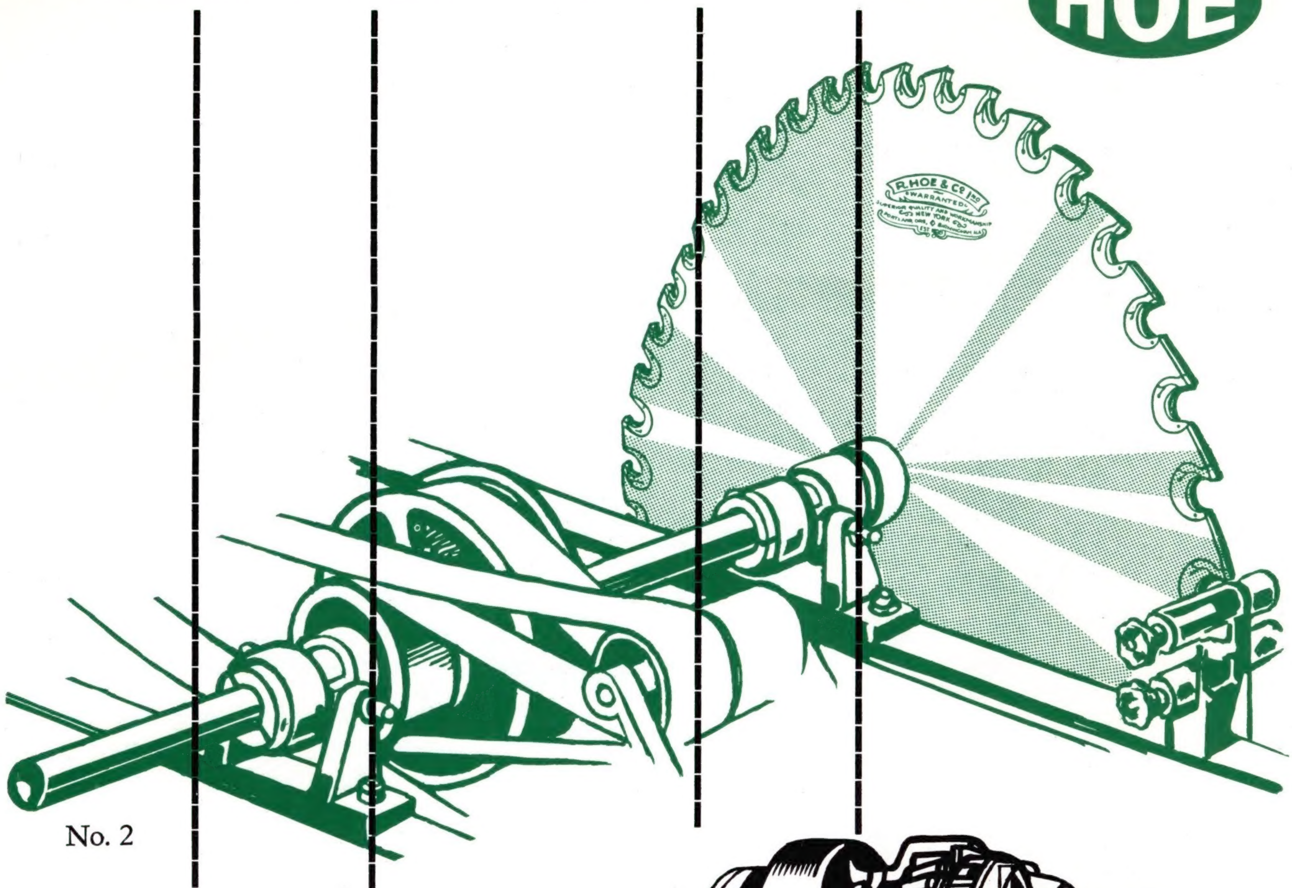
INSTRUCTIONS FOR "CHECKING OUT" CIRCULAR SAW MILLS AND CHISEL TOOTH SAWS

As saw manufacturers, our interests are equally divided between the Mill and the Saw, in as much as the successful operation of any new or perfectly fitted Solid Tooth or Chisel Tooth Circular Saw primarily depends upon the condition of the Mill. Therefore, whether the "set" is for long or short duration, the mill foundation must be solid enough to support the mill without sagging and rugged enough to withstand fast feeds and the shock of turning logs without shifting or moving.

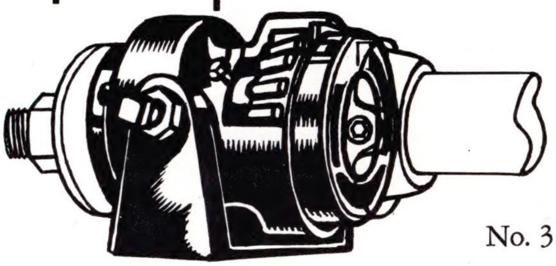
The Mill Manufacturers provide assembly and erection drawings for each size and style of mill made and we strongly recommend that these prints be carefully studied and followed in setting up your mill.

In addition, however, we recommend that careful observation be given the following points in making original installation and when "checking out", if trouble develops later on.

THE HUSK FRAME or CAB as it is sometimes called, carries the belt feed (if the Portable or Semi-Portable Type), saw guide, splitter, mandrel asembly and the Saw. It should be solidly and securely fastened to its foundation and braced if necessary so that it cannot shift due to "belt drag" or from pressure of feeding the log to the saw. In turn the mandrel bearing must be securely bolted to the husk to give it firm support. There is a powerful strain on the husk due to both end thrust and upward pressure generated by the blade when sawing. The bearing next to the saw should be set as close to the saw collar as possible. Check all tie-rods and bolts occasionally to be sure they are tight, especially in the dry, hot seasons.



No. 2



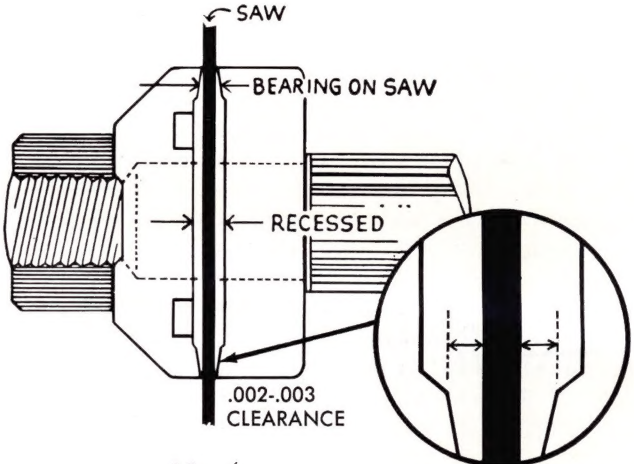
No. 3

ROLLER BEARING MANDREL BEARING

THE MANDREL — its condition and adjustment is of the greatest importance. Be sure it is straight and the face of the collars are perfectly true and that all bearings run cool. If the bearing next to the saw runs warm the heat generated is soon conducted to the center of the saw and no end of trouble will result, as the heat will expand the saw at the center, leaving the rim cool; thus dishing the saw. This condition must be corrected if possible, but if it cannot be done and the bearing stays at an approximate even temperature, the tension of the saw can be changed to compensate for the expansion caused by the warm bearing. Never allow the mandrel to become loose—in this condition it will raise when in the cut causing the saw to rub hard on the log side and drop back when out of the cut, thereby producing lumber which is not square and cause the feed to drag and pull very hard.

Be sure all pulleys, including belt-tightener pulley if used, are balanced and running true especially if running at high speed—this condition (pulley out of balance) will cause vibration in the Husk and effect the operation of the saw. Other direct causes are bad lacing in flat belts, "V" belts not properly aligned and defective collars.

THE SAW COLLARS hold the saw on the mandrel and give support to the blade as well. Collars of various sizes are furnished depending on the manufacturers of the equipment. However, the larger the collars the better the saw is supported and the better the saw will run. Assuming the mandrel is level and the collars true the saw should hang plumb on the mandrel. See Drawing No. 4. Be sure the saw fits snug on the mandrel—if forced on, the saw will cup or dish and in this condition it will not cut a true line. If center hole in saw is too large the bearing will be on top-side of center hole and the saw will be out of round as it hangs on the mandrel. Before mandrel nut is tightened be sure saw is pulled back against the lug pins to avoid shearing them off. Also, be sure lug pins are the correct length and are free of burrs and grooves. Always use a wrench to tighten mandrel nut and don't pull it up too tight as you may spring a perfectly ground collar.



No. 4

Mill manufacturers and other authorities on the subject do not agree as to collar design. Some recommend, and we agree, that both collars be tapered .002 to .003 from outer edge of collar inward for full width of face. Others recommend that the tight collar only be relieved and the face of the loose collar made perfectly flat or that both collars be made perfectly flat. All collars should be recessed since any fullness in the center will throw saw out of true.

The .002 to .003 clearance on the face of the collars as recommended will close up or lay almost flat to the saw plate when nut is tightened. If collars are flat, the loose collar especially may "turn out" at the outer edge and allow dirt to work in, causing saw trouble. Always keep face of collars clean and be sure that the entire periphery or outer edge of collars are bearing against the plate—open places on periphery can be detected by dark or rusty spots on face of collar.

The most common cause of trouble with mill saws is defective saw collars—changing of saws, failure to clean face of collars and shearing of lug pins all contribute to wear.

Proceed as follows for making a "quick check" on your collars.

a. Loosen arbor nut and retighten by hand so the collar is snug against the saw.

b. Loosen guide pins and reset so that there is about 1/16" clearance between blade and face of each pin.

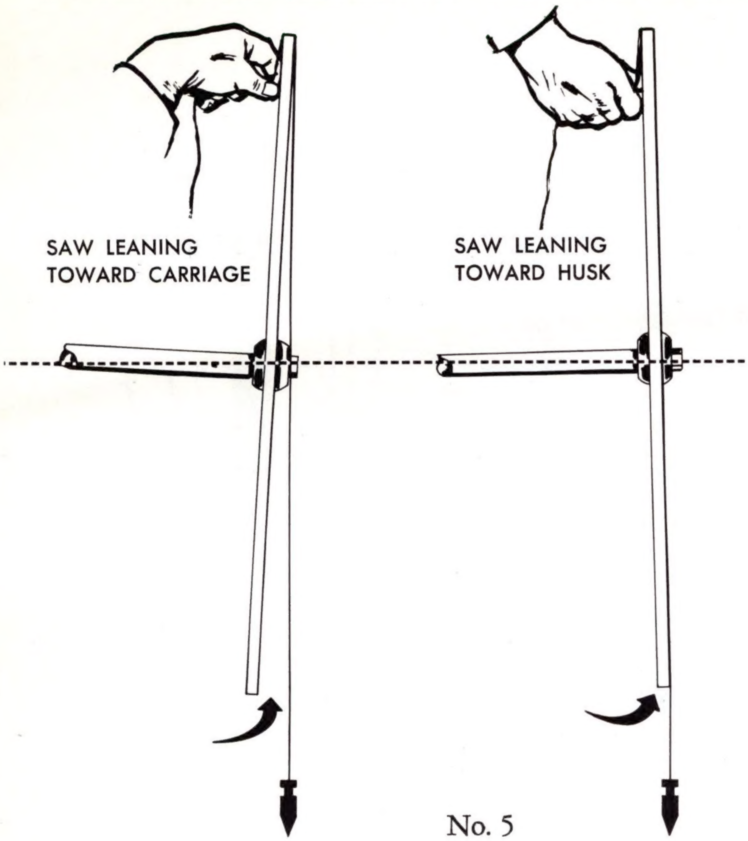
c. Hold saw in same position (do not turn) and tighten nut with wrench.

d. If the clearance between the guide pins has changed, the saw being closer to one pin than the other, the saw is dished due to defective collars unless there are burrs or ridges on lug pins or perhaps the tight saw collar is pushed back and the saw is contacting exposed center of mandrel. If defective, both collars should be refaced as indicated by drawing No. 4, and lug pins replaced.

We do not recommend papering the collars, but it is possible to temporarily correct this condition by proper use of paper rings. If the saw dishes toward the board or husk, cut a ring from a heavy sheet of paper the same diameter as the saw collar and about half the width of the face of the collar and place between the tight collar and the saw. If collars are badly worn a smaller paper ring should be cut small enough in outside diameter to fit inside the larger ring and this should be placed between the loose saw collar and saw. If saw dishes to log side the paper rings should be reversed. To apply rings to collars dip in oil or use a thin coating of cup grease.

On the other hand, if your saw touches the guide pins as mandrel is turned (nut tightened) your mandrel may be kinked or bent. To determine whether mandrel or saw is at fault turn saw to section coming closest to the guide pin (either side), remove mandrel nut and collar and turn saw back 1/2 turn (do not turn mandrel) replace collars and nut and retighten. If your mandrel is kinked or bent the blade will come up to same position on the pin. If saw pulls away from the pin at this point the trouble is with your saw—it needs retensioning.

If the saw is jammed into the log and lug pins are sheared, be sure to carefully examine collars for damage and especially check the saw plate under the collar line. Since the saw is stationary and the mandrel cannot be immediately stopped, the collars spin or rub against the saw plate, frequently resulting in metal from the collars being ground into the plate in lumps or smears. Reface collars and return saw to factory for reconditioning.



No. 5

CHECK THE SAW — The saw *must* hang perpendicular on the mandrel. This can be determined by dropping a plumb line down the face of the saw close to the center of blade, hooking the line over a shoulder in order to miss the shank. Do not use a level. See Drawing No. 5.

If the saw is out of plumb and the carriage and track are level—the last board will be:

a. Thinner at the top than at the bottom if saw tends to lean toward carriage—saw leads into log.

b. Thinner at bottom than at top if saw leans toward husk—saw leads out of log.

The following defects in mill set up would also cause the condition as outlined above:

a. Low or high track.

b. Knees out of plumb.

Do not try to correct this condition by holding the saw with the guide, either adjust by raising or lowering husk and/or track to level or by placing wedges under mandrel bearing saddles or yokes.

Variations in thickness of boards, other than last board may be due to:

a. Worn set works—pawls slipping.

b. Backlash between pinions on set shaft and rack under knees.

c. Worn shanks.

d. Dull teeth.

e. Fluctuation in saw speed due to inadequate power.

f. Motion in husk due to excess strain caused by uneven feeding of log to saw.

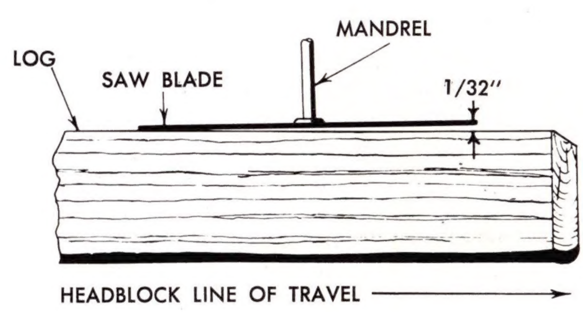
LEAD — is another variable, changing with the diameter of blade used and the timber being sawn. Too much or not enough lead will cause considerable trouble. The proper lead must be determined by trial and error —if there is not enough lead the saw will heat in the center and with too much lead it will heat on the rim—the lead must be just about right. The proper lead will hold the saw true in the cut—prevent it from running out of the log and automatically provide the necessary clearance at back of blade to miss the log or carriage return or gig back.

Saws should be run with least possible amount of lead. A fast feed requires less lead than a slow feed.

Assuming that the mill is properly set and level, adjustment for correct lead can easily be made as follows:

The lead is put in the saw by sluing the mandrel, therefore, the first thing to do is to determine present lead (see next paragraph) and the direction in which adjustment is to be made. Then loosen all mandrel bearing anchor bolts so that the mandrel can be freely adjusted without kinking (do not try to put lead in saw by shifting bearing next to saw only). However, if equipped with saddle type, self-aligning roller bearings and provided only slight adjustment for lead is needed, it can be made by backing off on supporting cap screws on all bearings on one side and tightening up on the other side.

Next, bring the rear headblock on your carriage up to front edge of saw so that a measurement can be taken from fixed mark on headblock base to blade just inside shank. Do not use the nose of the headblock to take your measurement, but scribe a line square across face of headblock on one side of base—a fine line is necessary since you are working in 32nds. Mark one tooth with chalk and take a reading on your scale or rule.

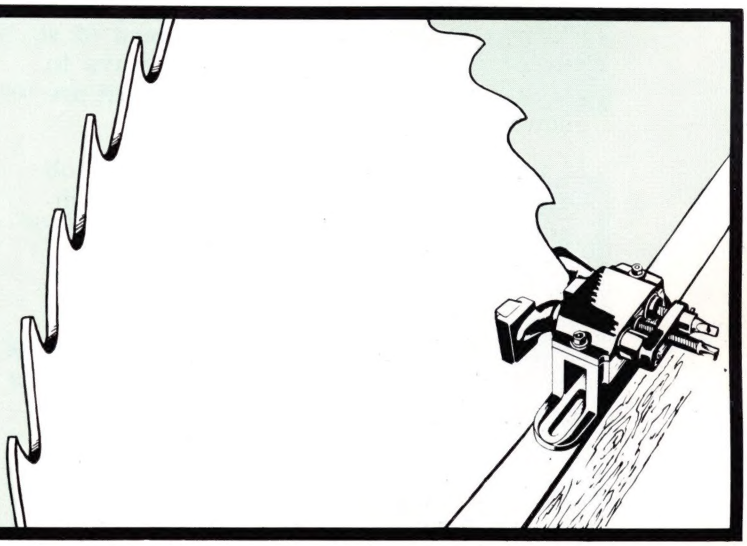


No. 6

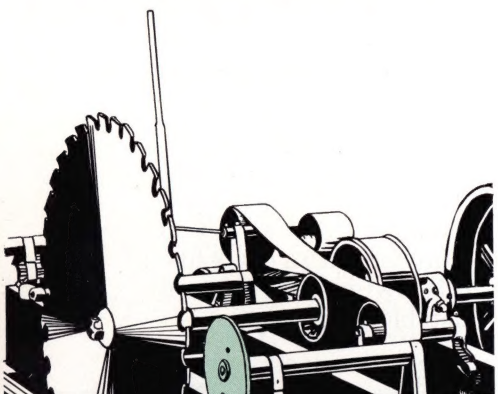
Move carriage ahead and turn saw so that the marked tooth is in same relative position to end of same headblock and measure again—(do not crowd saw). An alternate method is to clamp a pointed stick or file to headblock base just touching the front edge of blade, push carriage down track and watch indicator which should pull away from saw plate as the carriage moves back and show 1/32 clearance at rear of plate. If the pointer scrapes the saw half way across the plate you may still have too much lead due to a defect in your track. (See section on track). Adjust the mandrel at the bearings so that the measurement from the mark on the headblock to the saw plate or clearance between pointer and back of saw is 1/32″ greater at the rear than at the front of the saw. This will give you 1/8″ lead in 20 feet. See drawing No. 6. This method is accurate and allows the lead to be placed just as the carriage will operate. It is seldom that any two saws will run their best with the same lead. Do not attempt to change the lead or hold the saw in correct position with the guide pins.

(Also see paragraph on General Information, page 9)

THE GUIDE — the purpose of the saw guide is to steady the saw and should never be used to hold the "lead" in the saw. Set the guide as high as possible and ahead far enough to clear the bottom of the shanks by at least 1/4″. Be sure it is securely fastened to the Husk Frame and the guide arms are tightened securely. Final guide adjustment should be made while saw is running — move pins up to saw until daylight can just be seen between the saw and face of pin on each side, but not touching the saw.



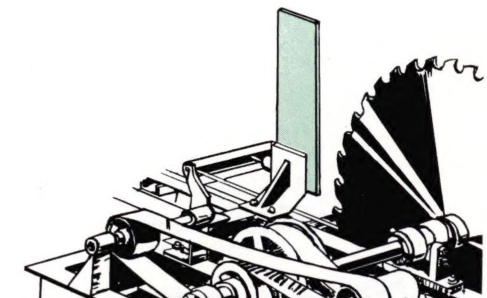
No. 7



SPREADER WHEEL

No. 8

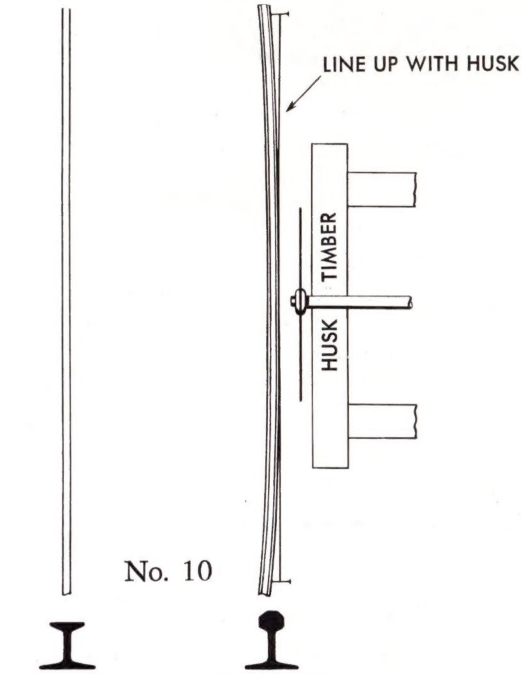
THE SPREADER — whether wheel or knife type should be about 1″ behind the teeth of the saw and set so that it is in line or flush with the logside of the saw. This keeps the board clear from the back of the saw, eliminating friction from rubbing and prevents scarring the lumber.



SPREADER KNIFE

No. 9

THE TRACK must be securely fastened to the way timbers which in turn must be of substantial dimension or set on heavier timbers to firmly support the carriage including load for full length of travel. The center section of track spanning the saw dust pit should be laid first, after the Husk has been set, exactly parallel with the Husk Frame and must be firmly supported so that no deflection occurs at this point. The guide track, whether next to the saw or on the far side should be straight and exactly parallel with the face of the tight saw collar before lead is set — check with straight edge and rule. (Some mills have two guide rails). The front and rear sections of track should be aligned with this center section (see drawing). A crooked guide rail will cause the carriage to travel on an arc instead of a straight line. There are several ways to check track alignment — the simplest are shown in drawing No. 10.



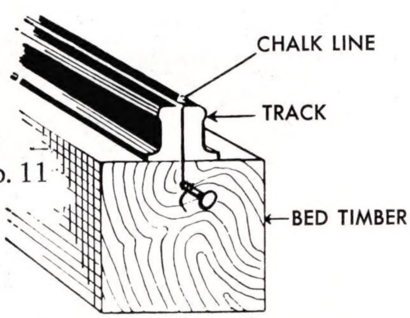
No. 10

If a mill "checks out" and does a good job cutting small or medium size logs but difficulty develops and the saw starts heating when sawing larger logs, there may be a weak section somewhere in your foundation, particularly over the dust pit. (The weight of the carriage with load plus the powerful "down pressure" in sawing will deflect at this point if this section is weak). If the saw leads out when cutting large diameter logs it indicates that the saw is lifting up in the cut (weak husk or loose bearing next to saw). If saw leads into the log it indicates the husk is shifting due to end thrust caused by feeding the log to the saw, thus throwing more lead in the blade (improper installation — husk not securely bolted down and braced). Unless corrected this will be a constant source of trouble. A recheck of track and foundation should be made under load. Any sag or dip in the foundation can be readily detected by placing a heavy log on the carriage and riding the carriage slowly down the track with a spirit level on the front end of the carriage. The level will show exact spot of deflection where reenforcement must be made.

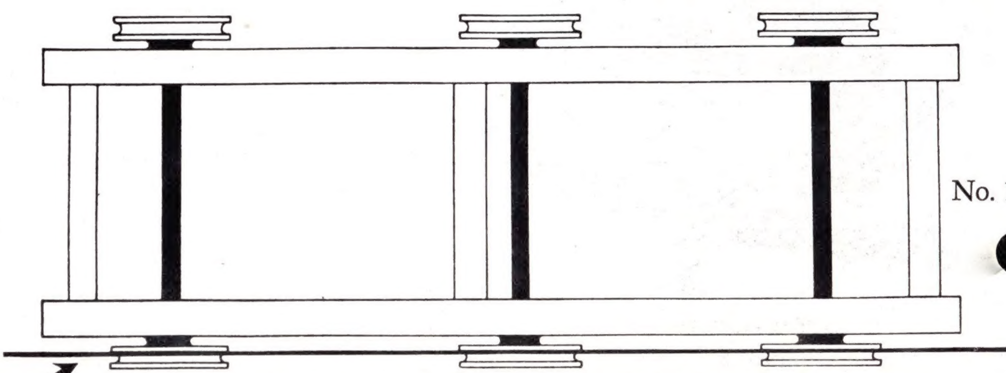
Trouble of this type is more apt to occur in the winter or spring due to frost, — raising the mill foundation in winter and dropping it down in the spring, resulting in trouble with saw due to varying condition of the mill.

THE CARRIAGE TRUCKS should be in perfect alignment to guide the carriage in a straight line past the saw in the cut. Trucks with end play will give same results as a crooked track. This condition allows the carriage to work to and from the saw, placing a great strain on the saw and results in thick and thin sawn lumber. Trucks should be aligned with a chalk line when assembling as illustrated in drawing No. 12. Most old type mills are provided with set collars on axles to hold this adjustment but later models have adjustable bearings.

No. 11



METHOD USED TO LINE UP END SECTIONS WITH CENTER SECTION



No. 12

CHALK LINE—SHOULD BE SAME DISTANCE FROM CARRIAGE SIDE AT EACH END

GENERAL SAW INFORMATION

In a great many instances where the new or retensioned saw will not run satisfactorily, it is extremely difficult to convince the owner or sawyer that his mill is at fault when his old saw is seemingly doing a good job.

However, in 9 out of 10 cases *it is* the fault of the mill—the old blade, in cutting over a long period, has gradually adjusted itself to compensate for the defects in the mill.

Now is the time to "check out" the mill as outlined and until this is done it must be assumed that the new saw is correct in all respects and after the mill is properly adjusted, the new or retensioned saw, in the majority of cases will cut a perfectly straight line and the old saw will not do the job it has been doing or will not work at all.

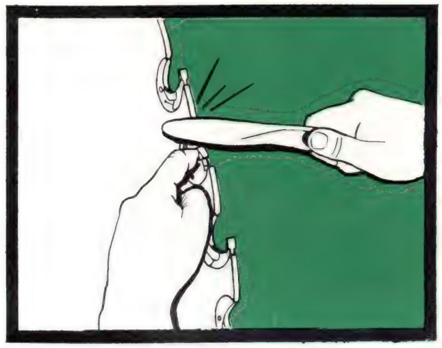
If your saw throws dust—any number of things can cause this, such as:

1. Saw out of plumb.
2. Improper filing (Teeth should always be filed square).
3. Worn shanks.
4. Shanks not lined up and properly seated or any number of other things but those mentioned are most common.

We have covered item No. 1 thoroughly in another section of this manual. Details on 2-4 are as follows:

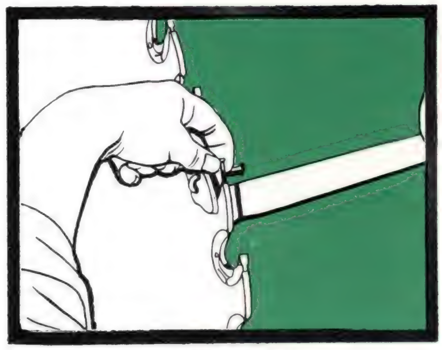
2. Filing—try to maintain the original cutting bevel and be sure corners are sharp and provide necessary clearance. (See page 12).
3. Shanks—when inserting new shanks or replacing worn bits be sure the "V" in the socket is free of dust and is well oiled.
4. When fitting saw with new shanks, start the shank in the socket with a light tap on ball of shank using handle of wrench which will seat it properly in the socket (do not put shank in wrench first and then try to insert). Then fit wrench pins in holes provided in shank, hold oiled bit in position with one hand in alignment with shank and pull into socket. If ball of shank and recess in bit are not in line a light blow with handle of wrench or hammer at this point, using a metal or wooden block on opposite side, will put them in alignment.

   After pulling the shank and bit into the saw, the shank should be firmly seated in the socket with a firm blow in the gullet, using a metal bar or handle of the wrench. See illustrations 14 through 18.



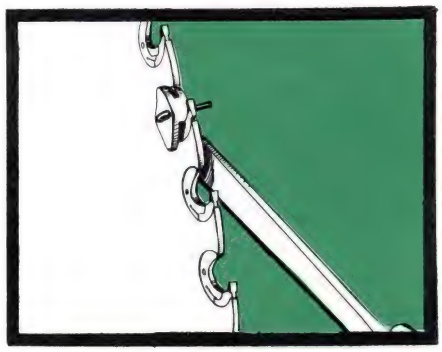
No. 14

STARTING THE SHANK



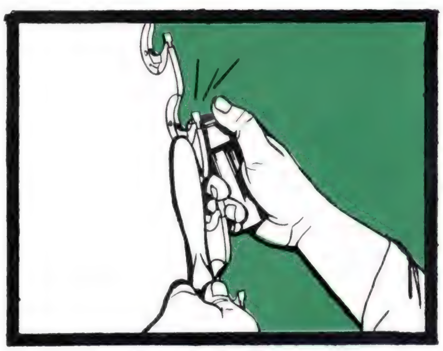
No. 15

SETTING THE BIT



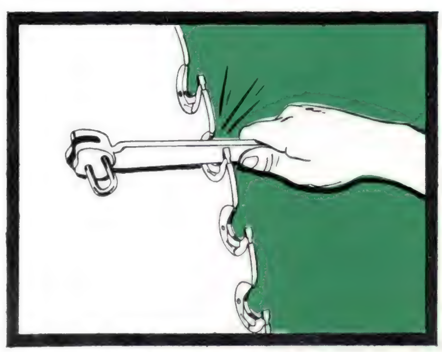
No. 16

PULLING SHANK & BIT IN SOCKET



No. 17

ALIGNING BIT & SHANK



No. 18

SEATING THE SHANK

SAW TROUBLES AND HOW TO CORRECT THEM

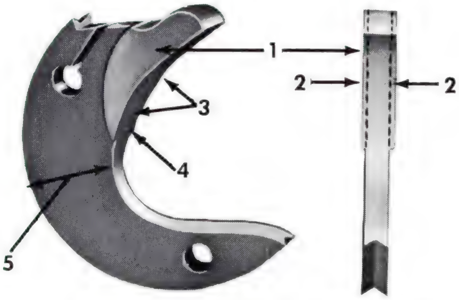
In the first part of this catalog we have covered in detail the setting up and operation of the Portable Circular Saw Mill, listing the prime mill conditions that contribute to poorly sawn lumber.

However, since the efficient performance of a sawmill is largely dependent upon the saw, it, in turn requires careful handling, expert care and attention.

Here we deal exclusively with the Chisel-Tooth Saw and its components and the many variables that cause poor saw performance.

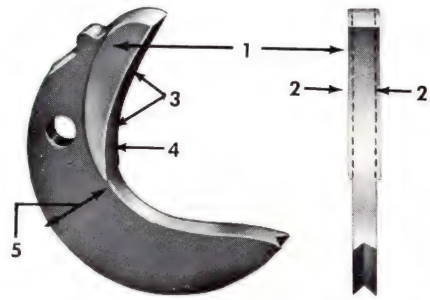
These conditions and faults, told by story and picture on this and following pages, will be easily recognized by both the amateur and experienced sawmill operator.

NEW SHANKS



SIDE VIEW FRONT VIEW

1. Flange.
2. Full flange thickness to remove dust.
3. Correct gullet form.
4. Sharp edges prevent dust by-passing shank.
5. Full width throat providing maximum expansion strength.

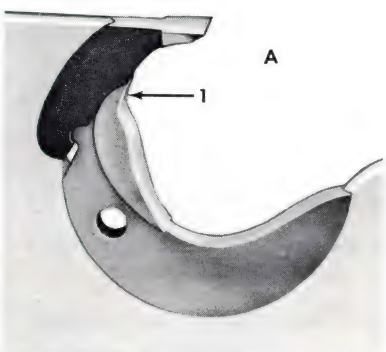


SIDE VIEW FRONT VIEW

The shank has two equally important functions: (1) hold the saw bits in place and (2) to chamber and remove the sawdust from the cut. The flange on the shank is there for the purpose of removing the sawdust and when the edges become worn through use it permits the dust to by-pass the shank and wedge in between the saw and the log, thereby setting up a friction which creates excessive heat affecting the tension of the saw.

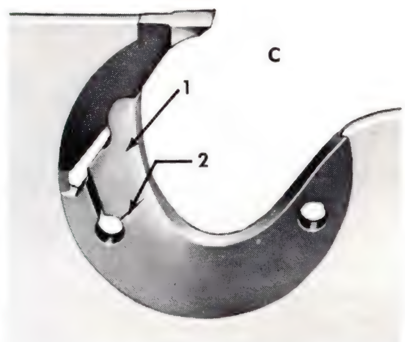
As the shank continues to wear and the sawdust in larger volume by-passes the shank, not only is the tension of the saw affected by the weakening shank but as this dust accumulates it passes through the gap between the base of the bit and the seat of the shank, wearing a channel in the saw plate at that point, weakening the shoulder of the socket.

PROGRESSIVE SHANK WEAR



A - 1—First indication of shank wear from force of chip friction — undercutting at ball of shank.

B - 1—Rounded edges and high center allows dust to by-pass gullet — filing straight across will restore sharp corners and keep dust and chips out of cut.

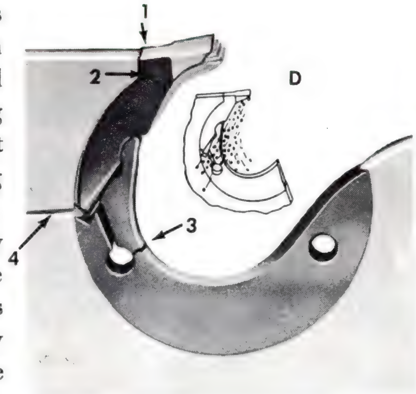


C - 1—With flange entirely worn away, the shank is no thicker than the saw plate, allowing sawdust to channel into the cut. Also, causes wear in the socket.

C - 2—Groove caused by flow of sawdust weakens shank causing it to break in many cases.

Shanks that have worn round on edges of the inner circle are also worn thin on the ball, resulting in a weakly supported bit at this point due to the reduced spring tension in the shank which allows the bit to cock and vibrate in the cut causing broken bits and badly sawn lumber.

Hammering or tensioning in many cases is necessary but can often be avoided by simply changing all the shanks or by inserting a new shank in every other gullet providing the shanks in use are not too badly worn.

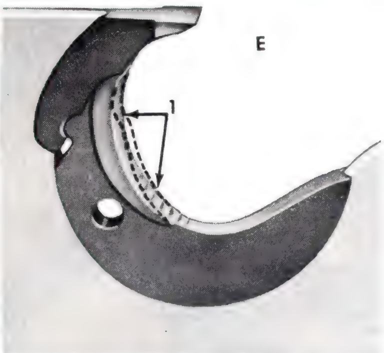


D - 1—Badly worn shank—flange completely gone and the ball (5) lacks sufficient bearing surface and strength to hold the bit firm against the shoulder of the saw.

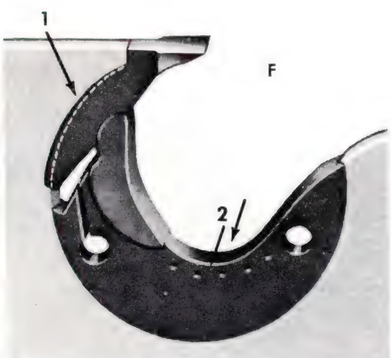
This condition will cause the bits to cock and chatter which tends to drive the shoulder back at (1), cause the bit to break at (2) and shank breakage at (3). This also affects tension by allowing the rim of saw to contract.

Sawdust in passing through gap between base of bit and top of shank wears a channel in plate of (4). Broken shoulders may result.

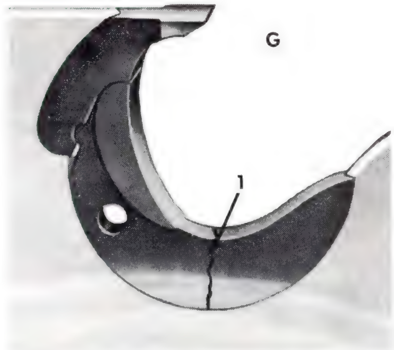
KEEP SHANK THROAT EDGES SQUARE



E - 1—Restore sharp edges on rounded gullets as soon as they show wear, by filing straight across the inner circle. Keep sharp for hard or frozen timber.

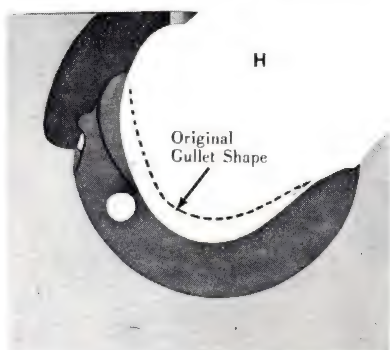


F - 1—If shanks become loose in the socket, oversize shanks can be furnished. If they are not immediately available and the shanks in use are in good condition, remove from saw and peen both sides on anvil at (2). This will make them fit tighter. Order oversize shanks as soon as possible.



G - 1—The saw guide pins should be set to clear the shanks. Pins rubbing on shank, as shown by shiny section causes case-hardening which is often the reason for shank breakage.
Remove shank and test hardness with a file — if too hard, discard and replace with new ones.

HOW TENSION OF SAW IS AFFECTED BY WORN SHANKS



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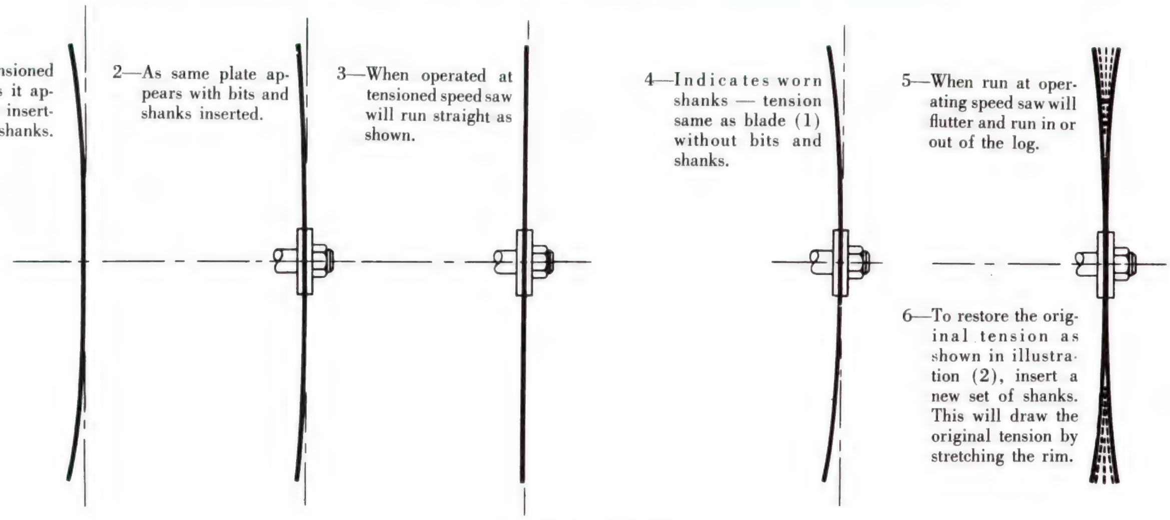
HOW TENSION OF SAW IS AFFECTED BY WORN SHANKS



1—Properly tensioned saw plate as it appears before inserting bits and shanks.

2—As same plate appears with bits and shanks inserted.

3—When operated at tensioned speed saw will run straight as shown.

4—Indicates worn shanks — tension same as blade (1) without bits and shanks.

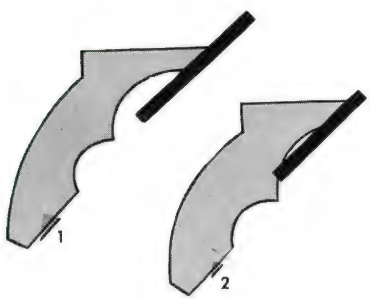
5—When run at operating speed saw will flutter and run in or out of the log.

6—To restore the original tension as shown in illustration (2), insert a new set of shanks. This will draw the original tension by stretching the rim.

IMPROVE YOUR FILING

Top efficiency and longer wear can be insured by good filing practice. The original shape of the tooth, corners and cutting bevel, must be maintained or a poor cutting saw will result.

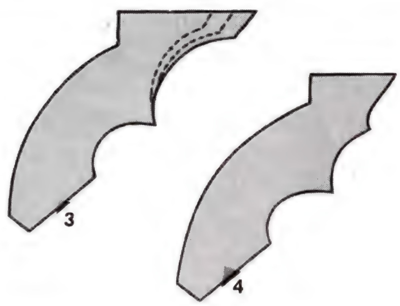
Avoid filing as shown by figures 2 to 11 below. These are common errors in bit filing. Follow instructions as outlined and you will notice an improvement in cutting and saw performance.



1 2

1 & 2—Do not file your bits with a square edge file as illustrated. Deep angular cuts in throat of bit can cause breakage. Use a Hoe No. 3 Special Round Edge File to maintain throat curve and original cutting angle on face of bit.

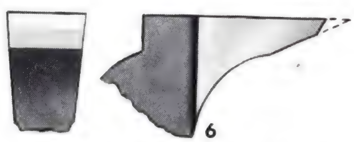
3 & 4—Keep the throat of the bit rounded as it is filed back as indicated by dotted line in illustration No. 3. Avoid filing as shown by illustration No. 4. This condition will cause the saw to run hard and consume more power.



3 4

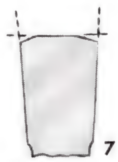
5

5—File straight across the face of the bit only —do not file on top. Conditions shown above are due to top filing. A saw will lead toward the high corner.



6

6—File bits at same angle as original bevel for best results. Undercutting in some cases is necessary but do not shorten the angle as in this illustration. Correct bevel angle is 35 degrees. (See Illustration No. 12.)



7

7—Condition shown above is result of rocking file across face of bit. This reduces clearance and will make saw pull hard and dodge in or out of log.

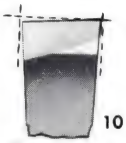
Top View

8

8—Rounded edges, caused by a circular motion when filing produces same results as outlined in Illustration No. 7.

9

9—Never file top of bit with file except to remove burr left by swaging. Excessive filing lowers the cutting edge, causes saw to pound and limits saw feed.

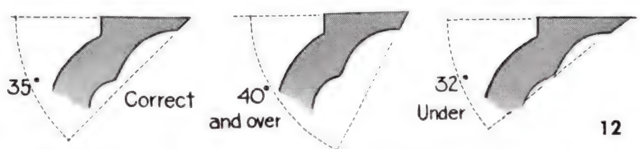


10

10—The above condition is the result of angle filing which produces a high corner on right or left side. Will cause saw to lead in or out of log.

11

11 — Be sure bits are swaged evenly. A heavy swage on one side will cause the saw to lead to the side.



12

12—Maintain original cutting angle of 35° for good saw performance. A 40° angle is too blunt—will cause saw to run hard, requiring more power. Undercutting at a sharper than 32° angle will cause saw bits to crumble. A sharp angle 32° - 34° angle sometimes is necessary when cutting hardwoods or frozen timber.

HOE

HOE SPECIAL LONG WEARING BITS

ARMORED BITS

Armored Bits are regular or standard saw teeth having a coating of tungsten carbide .002 to .004 thick applied to the wearing surface by brazing with a superior wear resistant alloy.

Due to its lower wear resistance, the face of the bit wears away under the armor so that the armor coating forms a projecting cutting lip which maintains the cutting clearance over long periods giving more production with considerably less "down time".

These bits are rapidly becoming extremely popular with the circular mill operator, not only because of their long wearing qualities but because unlike other hard bits, THEY CAN BE SWAGED.

Also, Armored Bits can be used to cut all kinds of timber under any condition.

STA-SHARP BITS

Sta-Sharp Bits are regular saw teeth with a stellite inlay. This is a very hard material and will hold a keen edge for long runs providing clean logs are available. These bits are ideal for Edger Saws but they cannot be swaged.

HIGH SPEED STEEL BITS

High Speed Steel Bits are made from a special high speed steel developed after many years of research. They should be used in sawing only clean logs. These bits are very popular for use in Edgers but they cannot be swaged.

ELECTRO BITS

Electro Bits are regular saw teeth with a hard chromium plating. Like the Sta-Sharp Bit they are recommended for sawing clean logs. These bits are ideal for Edger Saws but they cannot be swaged.

ANDRUS ELECTRIC SAW BIT GRINDER

The Andrus Electric Saw Bit Grinder, illustrated in photo at left, is highly recommended for sharpening all types of hard bits.

It is fast and easy to operate and will give you, with the proper grade wheel, sharp evenly ground teeth. A fifty-two inch saw can be sharpened in about three minutes. Motor, 110 volt, single phase, AC or DC, 2500 RPM. Is furnished complete with grinding wheel and extension cord.

A HISTORY OF HOE AND THE SAW

Rome wasn't built in a day. Neither was today's Hoe saw. It took 131 years of research and development to perfect that saw. It's been in the making ever since that day in 1828 when Robert Hoe opened his saw works in Ryder's Alley opposite Gold Street in lower New York City.

During that century and a quarter Hoe acquired the experience and developed the skill and know how which has enabled the company, the oldest saw maker in America, to produce what is reputed to be the finest saw blade known to the lumber industry.

The story of the progress of R. Hoe & Co., Inc., is essentially the history of the evolution of saw making in this country. Hoe was in on the ground floor of the industry and contributed much toward its advancement, maintaining a leadership in the trade.

Saws of numerous and varied crude tooth designs, shapes and sizes have been used throughout the ages. They have opened the way for civilization, aiding the prehistoric man, and the ancient peoples of the east as well as our own pioneers to clear the forests and obtain from them the material for buildings and for fashioning much of the furnishings that went into them.

It was a crude up-and-down saw that the early American pioneers used. It was a saw that had changed little in a century or more. Some were designed for hand operation, others were operated by a treadmill, and some by water power.

The advent of the circular saw was a sensation. In fact many doubted the practicability of the "buzz saw", as it was called, because of the sound caused by its then unheard of speed. It was developed in England late in the 18th century but didn't come into general use until about 1820.

Just eight years later (1828) Hoe brought out the first cast steel circular saw to be made in the United States. A solid tooth saw, crude in design and with little resemblance to the present-day blade, it was hailed as a revolutionary improvement on the up-and-down saw.

This was the saw produced in the little Hoe "Ryder's Alley" shop, where forge fires were blown by hand-pumped leathern bellows and the gentlemen mechanics came to work in high silk hats. The whole was a primitive operation compared to todays methods. In addition to saws, files, cane knives and trowels were also turned out.

It was but a few years before the business had outgrown the limited quarters of Ryder's Alley and the company moved to a more spacious establishment on Broome Street.

Then came one of the first refinements in the business of saw making. Up to this time saws, when being ground, were held to the grindstone by hand. This method was slow and gave unsatisfactory results. Now (1840) a new machine was developed for grinding saws. With this improved method the saws were laid on a reciprocating bed, but instead of a grindstone, a leaden wheel was rotated above the saw and fed with a mixture of emery, sand and soapy water to perform the grinding.

Next came the development of a hydraulic press for flattening saws which were put in the press hot as they came out of the tempering furnace.

In 1866 shop rights were purchased for the building of a new machine which further revolutionized the important process of surface grinding the saw. In this machine the saw was placed on the end of a stub mandrel mounted on a traveling carriage and grasped between a pair of driven rollers which caused it to revolve slowly in front of and at right angle to the grindstone. As the carriage was moved back and forth, by hand, the stone, adjustable through large hand wheel and screw was gradually moved against the saw blade, which was supported at the grinding point against a fixed steel bearing plate behind the saw.

But it was in 1869 that the really big advance in saw making was made. Then it was that the chisel tooth saw was first placed on the market.

Sawmill operators had long suffered severe and costly losses from frequent shutdowns of their mills to permit the sharpening of the teeth of the solid tooth blades.

Experiments had been conducted for some time past with inserted tooth blades, but the methods used in producing and inserting the teeth, proved too costly and impractical.

Then came the chisel tooth saw blade patents of W. P. Miller in October of 1866 and September of 1868. Hoe investigated the principles used, bought an interest in the patents and began marketing the chisel tooth blades in 1869.

By the new method sockets were cut in the edges of the blade as a portion of a true circle, with V-shaped edges. The teeth were made with a circular base and grooved edges. This permitted the teeth to fit tightly in the sockets. Both sockets and teeth were made to standard guage and to exact pattern so that they were interchangeable.

It was a crude attempt, in comparison with the product of today. Teeth inserts were first of one solid piece instead of bit and shank as is now the practice. But nevertheless this original design was a sturdy blade. This is evidenced by the fact that while the original style of chisel tooth plate has not been made for upwards of fifty years, until a comparative recent date, orders for replacement teeth continued to be received.

This is but a sampling of the progressive advance at Hoe toward the perfection in saw making. The inserted tooth saw was improved upon. There were developed special saws for special purposes.

Hoe craftsmen have always recognized the fact that every steel plate or blade has an individuality. Regardless of how carefully the alloy is prepared or how carefully the plate has been rolled, each will be different.

Every saw plate is carefully scrutinized before being stocked. They are carefully gauged to insure a uniform finished thickness. This all has a bearing on the operation and productivity of the saw.

It is when an order has been received and the proper plates have been selected that the real business of saw making begins.

Doctors could not be more painstaking at the birth of an infant than are the craftsmen and skilled artisans at Hoe, in giving life to the steel saw plate. Life, the difference between a scaly, dull, flat piece of steel and a shiny, vibrant, saw plate ready for the saw mill.

But life doesn't come easy to that steel plate.

After the center hole and pin holes are punched the next step is the treatment in the preheat chamber. There the plate is slowly brought up to a temperature of approximately 900 degrees. After it has been in this chamber for an extended period it is advanced to the hardening chamber. There it is gradually brought up to a temperature of 1490 degrees which is then maintained for about 40 minutes. Then it is removed and immersed in a bath of fish oil.

Now the plate goes to the next stage of the processing, and one of the most important steps — Tempering. For this operation the saw plate is thrust into the furnace and held flat between two dies weighing 1400 pounds each. The furnace is maintained at a temperature of 820 degrees. The procedure is truly breathing life into the steel to condition it for the give and take of rigorous service.

Removed from the tempering furnace, the plate is permitted to drop to room temperature. Then another test, this time the 47-48 Rockwell C-Scale test. If it passes this test the plate is ready for the next steps in the process. The rims are smithed and ground to gauge, sockets for the teeth are milled and the first hammering.

It is by hammering, the work of the sawsmiths, that the plate is tensioned for the speed it is to run on the mill.

The sawsmith is a highly skilled craftsman, the aristocrat of mechanics and one of the highest paid of shop trades. There is a very limited number of sawsmiths in the entire United States. Besides a collection of carefully selected hammers, straight edges, etc., the sawsmith has for tools a carefully tuned vibratory sense and keen sight to effect that important tension.

The importance of tension in a saw plate was for a long time unknown. Eventually it was determined that when the saw plate is running at high speed, the rim having the greater circumference, travels faster than the center. It was found that the rim, under these circumstances, had a greater expansion than the center due to the centrifugal force.

The sawsmith, after carefully computing this expansion, with consideration given to diameter, gauge and intended operating speed, proceeds to tension the saw by means of hammering, which conditions the saw blade to run with precision.

Saw plates are not hammered once but four times at Hoe. The first hammering flattens the plate and deals particularly with the rim. The rim only is then fully ground to exact gauge.

The next operation is milling the sockets in the saw plate which operation is performed on two fully automatic milling machines using carbide tipped cutters. This is a dual operation, the "Hogging" cut being taken on one machine and the finish "V" as milled on the second unit. A recent addition to our product line is the new Hoe Blue Shoulder Saw in the B & F type pattern. A new unique machine was designed and built as an auxiliary to the other automatic millers to mill the sockets of the Blue Shoulder Saw.

After blade is milled and V cut in sockets, shanks and bits are inserted, the second of anvil operations called smithing is done. In this operation the blade is leveled and tension started, it is then sent to the grind shop for the first grind. The saw is ground to within .008 of required gauge. Once again it is returned to anvil room for leveling and regulating of the tension. This operation is called hammering. After hammering it is returned for the final grinding to required gauge.

The next important operation is polishing, which also must be done carefully, by experienced men, so as not to draw the plate to either side through excessive heat. In other words both sides of the saw must be polished evenly.

Now comes the fourth hammering, that important phase of the process known as "blocking". This is the finishing operation and final insurance of an equal tension on all parts of the blade for precision cutting.

All of the painstaking care and attention to the finer points of manufacturing detail that went into turning out the saw blade are repeated in the production of the teeth.

Each tooth is in two pieces — bit and shank.

Bit and shank are held firmly in the blade socket without aid of bolt, screw or burr. Made fractionally larger than the socket, an ingenious design permits them to be sprung into place and wedged into rigid stability.

The bit is produced in a series of ten from a strip of specially rolled alloy steel.

First heated to a temperature of 2100 degrees, the steel is forged and the bits take primitive form as drop forgings. Then the forgings are inspected, sheared and formed.

The next step in the production of the bits is the heat treatment in Atmospheric-Controlled Furnaces.

For a next step in the process the bits are returned to the fully automatic grinding machines for finish grinding the tops, sides and face of each bit.

Finally the bits are subjected to the 450 degree blue tempering process.

As for the shanks, the first operation is blanking where they are stamped out of a steel strip on a punch press.

Now the shanks are put on milling machines where the inner circle is milled, sides are milled to reduce them to the proper gauge or thickness and they are also milled to effect the tapered flange.

Next comes the drilling on automatic drill press, of wrench pin hole and slot hole. Then the slot is ground in to meet slot hole. The slot gives the shank the spring which enables it to be snapped into the rigid stability of the blade sockets.

The shanks are then returned to the milling machines for grooving; also for head milling.

Now the shanks are subjected like the bits to heat treatment in rotary gas furnaces, then quenched in oil, cleansed, tested for hardness and finally placed in the tempering furnaces.

But before shipment to the customer each shank is individually subjected to the "pull test", a test of their ability to withstand the rigors of actual service under the most demanding operating conditions.

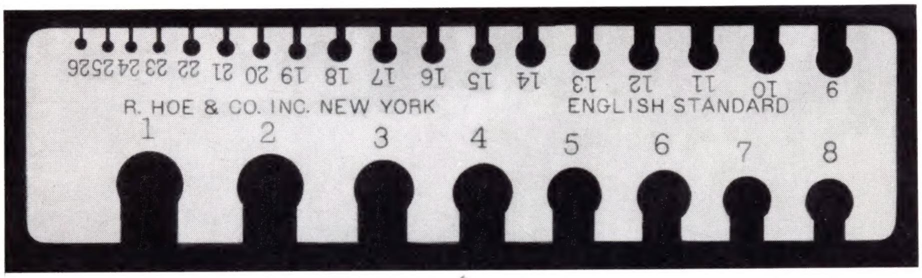
Hoe is jealous of its reputation for the excellence of its products. There is never the inclination for rushing jobs through the shop. Every item must come up to the high standards that have ruled since the beginning. Result — there is at least one very evident testimonial to the Hoe success.

By 1929, the company had so far outgrown its Broome Street quarters that it moved to a new site in the Bronx. Today its New York plant occupies three solid city blocks on East 138th Street, with its own rail siding and East River docks, which the plant abuts. There are also plants in Birmingham, Alabama, Portland, Oregon, High Point, N. C., Seattle, Wash., and branches in Chicago, Ill. and Memphis, Tenn.

Hoe saws are now in use throughout the United States in every state in the Union and in just about every country in the world.

MEASURING THE THICKNESS OF CIRCULAR AND BAND SAWS

The gauge measurements of all Saws shown in this catalog are based on Birmingham or Stubbs standard English Wire Gauge, which is the standard practice with all American Saw Manufacturers. The following table shows the gauge equivalents in fractions and decimals of an inch, also in Millimeters.



STANDARD SAW GAUGES

Gauge (Birmingham)	Fraction Inch	Thousandths Inch	Millimeters
	1	1.000	25.40
	$\frac{7}{8}$	.875	22.225
	$\frac{3}{4}$	.750	19.05
	$\frac{5}{8}$	.625	15.875
	$\frac{1}{2}$	.500	12.70
	$\frac{15}{32}$	.4688	11.905
0000	$\frac{29}{64}$	.454	11.53
000	$\frac{27}{64}$ Full	.425	10.79
00	$\frac{3}{8}$ Full	.380	9.65
0	$\frac{11}{32}$ Scant	.340	8.64
1	$\frac{5}{16}$ Scant	.300	7.62
2	$\frac{9}{32}$	.284	7.21
3	$\frac{1}{4}$ Full	.259	6.57
4	$\frac{15}{64}$	.238	6.04
5	$\frac{7}{32}$	.220	5.59
6	$\frac{13}{64}$	.203	5.18
7	$\frac{3}{16}$ Scant	.180	4.57
8	$\frac{5}{32}$ Full	.165	4.19
9	$\frac{5}{32}$ Scant	.148	3.76
10	$\frac{1}{8}$ Full	.134	3.40
11	$\frac{1}{8}$ Scant	.120	3.05
12	$\frac{7}{64}$	.109	2.77
13	$\frac{3}{32}$	.095	2.41
14	$\frac{5}{64}$ Full	.083	2.10
15	$\frac{5}{64}$ Scant	.072	1.82
16	$\frac{1}{16}$ Full	.065	1.65
17	$\frac{1}{16}$ Scant	.058	1.47
18	$\frac{3}{64}$	.049	1.24
19	—	.042	1.06
20	—	.035	.89
21	$\frac{1}{32}$	.032	.81
22	—	.028	.71
23	—	.025	.64
24	—	.022	.56
25	—	.020	.51
26	—	.018	.46
27	$\frac{1}{64}$	.016	.41
28	—	.014	.36
29	—	.013	.33
30	—	.012	.30

When you need technical assistance . . . "Buzz" Hoe

R. HOE & CO., INC.

910 E. 138TH STREET NEW YORK 54, N. Y.

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